Catalogue of American Amphibians and Reptiles.

HULSE, ARTHUR C. 1977. *Bufo kelloggi*.

Bufo kelloggi
Little Mexican Toad

Bufo kelloggi Taylor, 1936: 510. Type-locality, "Two miles east of Mazatlán, Sinaloa." Holotype, Field Museum of Natural History 100088 (formerly E. H. Taylor and H. M. Smith 21), a female (43 mm snout-vent length) collected by E. H. Taylor, 21 July 1934 (not examined by author).

Bufo debilis kelloggi: Sanders and Smith, 1951: 156.

• CONTENT. No subspecies are recognized.

• DEFINITION. A small member of the *Bufo debilis* species group (Sanders and Smith, 1951; Savage, 1954) with mature males ranging from 29–36 mm and females from 29–44 mm (Bogert, 1962). The parotoid glands are large, but low and inconspicuous, widest at the anterior end. Warts on parotoid glands are diffuse, but with dark points. The cranial crests are surmounted by high, dark tipped warts forming a continuous ridge; the suborbital crest reaches no further forward than below the preorbital crest. The entire dorsal and lateral surfaces of the body are covered with numerous, large, conical tubercles. The dorsal background coloration is yellowish brown with numerous large, black blotches that often form elongate spots. The ventral coloration is yellowish white with black spotting along the lateral abdominal region and across the pectoral area. The chin is immaculate in females and diffuse black in males, with a well developed median vocal sac.

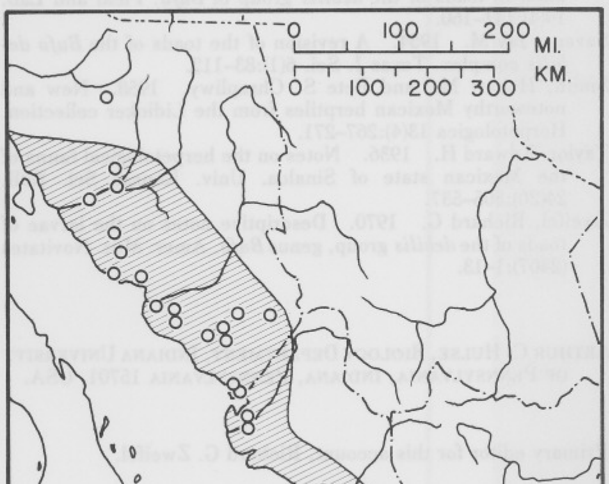
• DESCRIPTIONS. Taylor (1936) supplied a good description of the holotype. Savage (1954) gave additional detailed descriptions of the adults, including diagnostic measurements of both males and females. Sanders and Smith's (1951) comparison of *Bufo kelloggi* with other members of the species group emphasized external morphology, but included some comments on osteology. Ferguson and Lowe (1969) described coloration, cranial osteology, cranial crests, and parotoid glands. Martin (1972) briefly described the osteology of the species group, placing major emphasis on cranial characters. Eggs were described by Ferguson and Lowe (1969) and Zweifel (1970). Zweifel (1970) discussed egg size, general tadpole morphology, and coloration, noting some differences in coloration among species of the group. Tadpole morphology is similar in all members of the species group, and all differ in several ways from other *Bufo*. They are unique in possessing only two rows of lower labial teeth and in having a dextral anal opening as opposed to one or three rows of labial teeth and a medial anal opening in the species thus far studied.

The ova of *B. kelloggi* before preservation are about 1.17 mm in diameter and are heavily pigmented in the upper third, in contrast to other members of the group where the eggs are less densely pigmented. Larvae of all members of the group at hatching are between 3.1 and 3.4 mm total length. They hatch at a later stage than do most *Bufo*—stage 19 as contrasted to stage 16 or 17 for other species (Zweifel, 1970).

Riemer (1955) described the call as "a medium strength, medium pitched, bee-like buzz quite reminiscent of *Microhyla carolinensis*." Bogert (1962) analyzed the mating call: trill rate 132 pulsations per second, duration 2.4 to 3.6 sec ($\bar{X}$ = 2.8), and emphasized frequency 3,900 to 4,600 Hz. At similar temperature in areas of overlap, *Bufo kelloggi* had a call approximately 1,000 Hz higher than *Bufo retiformis* (Bogert, 1960).

• ILLUSTRATIONS. No color illustrations are published. Taylor (1936) presented black and white photographs of the holotype, a young individual, and a patatypic male. Bogert (1962) gave additional black and white dorsal views of several series of specimens. Ferguson and Lowe (1969) supplied a picture of a female *B. kelloggi* that was described by Sanders and Smith (1951) as a *kelloggi* × *retiformis* hybrid and also presented a picture of what they considered to be a true hybrid described by Riemer (1955). Martin (1972) included a dorsal view of the skull and Ferguson and Lowe (1969) a dorsal-frontal view of the skull. Zweifel (1970) presented line drawings of the tadpoles' mouthparts and several larval stages. Ferguson and Lowe (1969) gave a line drawing of the egg. Savage (1954) included a diagrammatic representation of the skin pattern as compared to other members of the species group. Bogart (1972) illustrated the karyotype and ideogram of the chromosomes and Bogert (1962) presented sonograms of the species at normal and at one-fourth normal speeds.

• DISTRIBUTION. Bogert (1962) stated that *Bufo kelloggi* is restricted almost entirely to the narrow Pacific Coastal Plain of western Mexico between latitudes 22° and 29°N, from Rosamorada, Nayarit to just south of Hermosillo, Sonora. Additional collecting has extended the known range of the species northward from Hermosillo almost to Santa Ana, Sonora. If correct, this record places the population out of the coastal plain and into the foothills of the nearby mountains. In addition several records now exist that extend the range of the species slightly further south along the Pacific Coastal Plain than Rosamorada; most of these records come from the vicinity of San Blas and Santa Cruz, Nayarit. Two locality records are suspect: Gunsight, Pima County, Arizona (Univ. of Illinois Mus. Natur. Hist. No. 67840), and Ixtlan, Nayarit (UIMNH No. 80759); the former locality is not represented on the distribution map. The specimen from Gunsight is obviously either



MAP. The solid circle marks the type-locality; open circles indicate other localities. Records outside of the hatched area are questionable or possibly outside the main area of distribution.

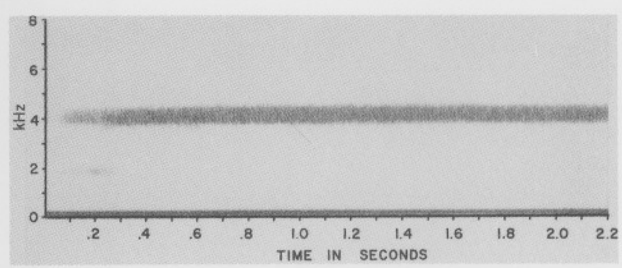


FIGURE. Audiospectrogram of call of *Bufo kelloggi*: 6 mi SW San Blas, Sinaloa, Mexico, 20 Aug. 1956, water 25.5°C; start of call only, narrow band (45 Hz) filter. Amer. Mus. Natur. Hist. Dept. Herpetology tape.

a misidentified *Bufo retiformis* or a mislabeled *Bufo kelloggi* from south of the International Boundary. The Ixtlan specimen was rejected by Bogert (1962) on the grounds that it removed the species from the Pacific Coastal Plain; however, this may be the case as the Santa Ana record also occurs away from the Coastal Plain. Further collecting in the southern interior of Nayarit is needed to clarify the southern limits of the range. The most complete range map previously published is that of Bogert (1962).

Bufo kelloggi appears to inhabit most commonly the open flat areas of the thorn forest and deciduous tropical forests below an elevation of 700 feet (Bogert, 1962), no additional information concerning the overall distribution and habitat of the species occurs in the literature.

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. Bogert (1962) discussed dispersal and distribution of *Bufo kelloggi* including its zone of sympatry with *Bufo retiformis* and concluded that due to habitat manipulation for agricultural uses it appeared that *B. retiformis* was replacing *B. kelloggi* to the south and west of Hermosillo. Habitat was discussed by Bogert (1960) and Ferguson and Lowe (1969). Effects of temperature and humidity on calling activity were discussed by Ferguson and Lowe (1969). *Bufo kelloggi* calls from the margins of ponds either in the water or on the shore a few centimeters from the water. Eggs are laid singly or in short strands (Blair, 1972a).

Bogert (1962) and Ferguson and Lowe (1969) analyzed mating call in *Bufo kelloggi* and noted differences in pulse rate, duration, and emphasized frequency from other members of the species group.

Ferguson and Lowe (1969) discussed intragroup hybridization with *B. retiformis* and *B. debilis* and intergroup hybridization with *B. punctatus*. Blair (1972b) also examined intra- and intergroup hybridization. In a *B. kelloggi* × *B. debilis* cross, 10.8% of the fertilized eggs underwent metamorphosis, even greater success was recorded for the intergroup cross with *B. punctatus* where 28.4% of the fertilized eggs reached metamorphosis. In a cross with *B. speciosus* all animals died during larval stage. Riemer (1955) discussed what he considered to be hybrids between *Bufo kelloggi* and *B. retiformis*, but Bogert (1962) stated that they were *B. kelloggi*.

Bogart (1972) reported on chromosome number ($2n = 22$) and configuration. Blair (1972c) gave characteristics of the testes and Cei et al. (1972) discussed biogenic amines in the skin of one specimen. Guttman (1972) discussed hemoglobin and transferrin phenotypes.

Distributional records and miscellaneous notes are in the following: Davis and Dixon (1957); Chrapliwy (1956); Hardy and McDiarmid (1969); Riemer (1956); and Smith and Chrapliwy (1958).

• REMARKS. Some controversy has arisen as to the species grouping of *B. kelloggi*. Bogert (1962), Sanders and Smith (1951), Savage (1954), and Zweifel (1970) all consider *B. kelloggi* to be a member of the small *debilis* group of *Bufo* along with two other species: *Bufo debilis* and *B. retiformis*. Ferguson and Lowe (1969) after examining several aspects of the biology of the above species and *Bufo punctatus* contend that all four species form a natural species assemblage with *Bufo punctatus* being the most primitive.

• ETYMOLOGY. The specific name *kelloggi* is in honor of Remington Kellogg.

LITERATURE CITED

Blair, W. Frank. 1972a. *Bufo* of North and Central America, p. 93–101. *In* W. Frank Blair (ed.), Evolution in the genus *Bufo*. University of Texas Press, Austin. viii + 459 p.

— 1972b. Evidence from hybridization, p. 196–232. *In* W. Frank Blair (ed.), op. cit.

— 1972c. Characteristics of the testes, p. 324–328. *In* W. Frank Blair (ed.), op. cit.

Bogart, James P. 1972. Karyotypes, p. 171–195. *In* W. Frank Blair (ed.), Evolution in the genus *Bufo*. University of Texas Press, Austin. viii + 459 p.

Bogert, Charles M. 1960. Influences of sound on the behavior of amphibians and reptiles, p. 137–320. *In* Lanyon, W. E., and W. N. Tavolga (eds.), Animal sounds and communication. Amer. Inst. Biol. Sci. Publ. (7):xiii + 443 p.

— 1962. Isolating mechanisms in toads of the *Bufo debilis* group in Arizona and western Mexico. Amer. Mus. Novitates (2100):1–37.

Cei, Jose M., Victor Erspamer, and M. Roseghini. 1972. Biogenic amines, p. 233–243. *In* W. Frank Blair (ed.), Evolution in the genus *Bufo*. University of Texas Press, Austin. viii + 459 p.

Chrapliwy, Pete S. 1956. Extensions of known range of certain amphibians and reptiles of Mexico. Herpetologica 12(2):121–124.

Davis, William B., and James R. Dixon. 1957. Notes on Mexican amphibians with description of a new *Microbatrachylus*. Herpetologica 13(2):145–147.

Ferguson, J. Homer, and Charles H. Lowe. 1969. Evolutionary relationships in the *Bufo punctatus* group. Amer. Midland Natur. 81(2):435–466.

Guttman, Sheldon I. 1972. Blood proteins, p. 265-276. *In* W. Frank Blair (ed.), Evolution in the genus *Bufo*. University of Texas Press, Austin. viii + 459 p.

Hardy, Laurence M., and Roy W. MacDiarmid. 1969. The amphibians and reptiles of Sinaloa, Mexico. Univ. Kansas Publ. Mus. Natur. Hist. 18(3):39–52.

Martin, Robert, F. 1972. Evidence from osteology, p. 37–70. *In* W. Frank Blair (ed.), Evolution in the genus *Bufo*. University of Texas Press, Austin. viii + 459 p.

Riemer, William J. 1955. Comments on the distribution of certain Mexican toads. Herpetologica 11(1):17–23.

Sanders, Ottys, and Hobart M. Smith. 1951. Geographic variation in toads of the *debilis* group of *Bufo*. Field and Lab. 19(4):141–160.

Savage, Jay M. 1954. A revision of the toads of the *Bufo debilis* complex. Texas J. Sci. 6(1):83–112.

Smith, Hobart M., and Pete S. Chrapliwy. 1958. New and noteworthy Mexican herptiles from the Lidicker collection. Herpetologica 13(4):267–271.

Taylor, Edward H. 1936. Notes on the herpetological fauna of the Mexican state of Sinaloa. Univ. Kansas Sci. Bull. 24(20):505–537.

Zweifel, Richard G. 1970. Descriptive notes on the larvae of toads of the *debilis* group, genus *Bufo*. Amer. Mus. Novitates (2407):1–13.

ARTHUR C. HULSE, BIOLOGY DEPARTMENT, INDIANA UNIVERSITY OF PENNSYLVANIA, INDIANA, PENNSYLVANIA 15701, USA.

Primary editor for this account, Richard G. Zweifel.

Published 31 October 1977 by the SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES.